

DESCRIPTION OF A NEW GENUS OF LEPTOPHLEBIID
MAYFLY FROM AUSTRALIA (EPHEMEROPTERA:
LEPTOPHLEBIIDAE: ATALOPHLEBIINAE)

By J. C. DEAN

Water Sciences Laboratories, Melbourne and Metropolitan Board of Works, 68 Ricketts Road,
Mount Waverley, Victoria 3149

ABSTRACT: The genus *Neboissophlebia* is established to accommodate two species of leptophlebiid mayflies, *N. hamulata* sp. nov. from south-eastern Australia, and *N. occidentalis* sp. nov. from south-western Australia. Male and female imagos, subimagos, and nymphs are described for both species.

The systematics of Australian mayflies have for many years been neglected. The Australian fauna is dominated by the family Leptophlebiidae, but, despite early contributions by Tillyard (1934, 1936) and Harker (1950, 1954, 1957), and recent publications by Campbell and Peters (1986), Suter (1986) and Dean (1987), many genera remain undescribed or inadequately described. The following account establishes a new genus for two new species of Leptophlebiidae, one from south-eastern Australia and the other from south-western Australia.

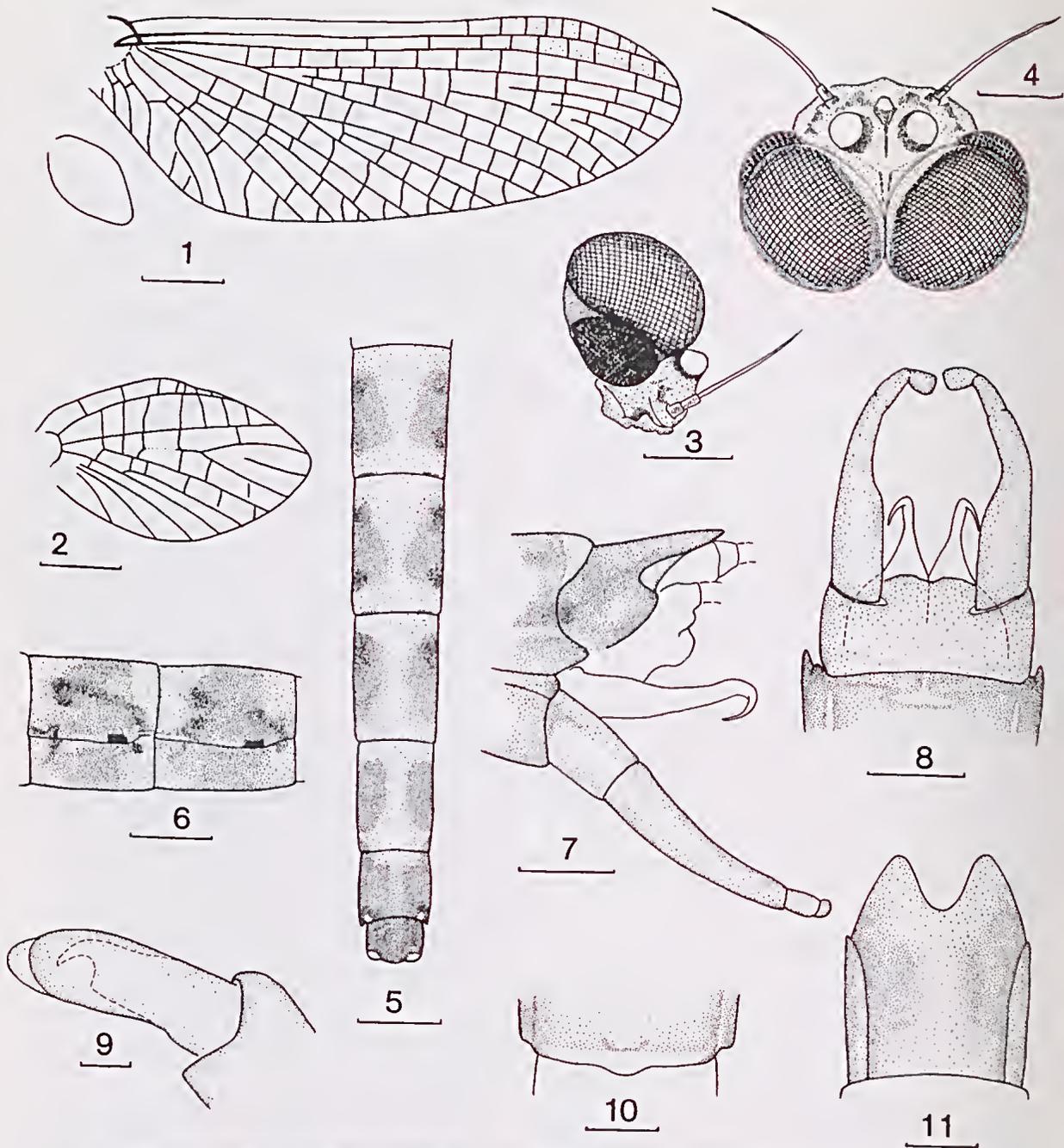
All observations have been based on material preserved in alcohol. Holotypes and paratypes are lodged in the Museum of Victoria, Melbourne (MVM). For drawing, wings have been mounted on a slide, photographed, and traced from a projected transparency. Other imago and nymphal parts have initially been drawn unmounted, and then prepared for detailed examination by mounting in polyvinyl alcohol-lactophenol. All measurements have been made using an eye piece graticule.

Genus *Neboissophlebia* gen. nov.

DIAGNOSIS: *Imago*. Length of male: body, 6.8-8.4 mm; forewings, 7.1-8.3 mm. Length of female: body, 6.2-8.3 mm; forewings, 7.3-9.0 mm. Forewing: length 2.8-3.1X width (Figs 1, 26); membrane hyaline, costal and subcostal cells in apical third of wing translucent, whitish; costal crossveins in basal half of wing weakly developed and inconspicuous, or absent, usually 9-14 costal crossveins in distal half of wing; vein Rs forked 0.20-0.25 distance from base to wing margin; vein MA forked less than to a little more than 0.5 distance from base to wing margin, fork symmetrical; MP_2 attached at base by crossvein to MP_1 , at 0.20-0.23 distance from base of MP_1 to wing margin; ICu_1 and ICu_2 parallel or very slightly diverging as wing margin approached, never linked by crossveins or with an intercalary; ICu_1 usually linked to $CuA-CuP$ crossvein; forewing 4.9-6.3X length of hindwing. Hindwing: length 1.7-1.8X width (Figs 2, 27); costal margin with shallow concavity just beyond midpoint, distal to this costal space narrowing gradually; vein Sc joining costal margin at 0.66-0.76 wing length. Length ratios of segments in forelegs of male 0.64-0.72; 1.00 (2.2-2.6 mm); 0.04-

0.05; 0.33-0.40; 0.38-0.46; 0.26-0.39; 0.10-0.12. Tarsal claws dissimilar, one with an apical hook and opposing ventral flange, the other swollen and without a hook (Fig. 9). Male genitalia: penes fused in basal half only (Figs 7, 8, 29, 30); each lobe with outwardly-directed, terminal projection, sperm duct opening at apex of projection; length of styliger plate along median line a little less than 0.4X maximum width. Female genitalia: sternum 9 with deep apical cleft (Figs 11, 31); genital extension on sternum 7 small, extending less than 0.1 along length of sternum 8 (Fig. 10). Terminal filament a little longer than cerci.

Mature nymph. Antennae 1.5-2.0X length of head. Lateral margins of clypeus diverging slightly to anterior. Width of tentorial body decidedly greater than length. Labrum: subequal or slightly wider than clypeus; width 2.3-2.5X length along median line (Figs 17, 32); anterior margin concave, with five inconspicuous denticles; secondary hair fringe set back from anterior margin 0.4-0.5 length along median line. Mandibles: outer margin evenly rounded; sparse tuft of long hairs at midpoint and scattered long hairs basal to this (Fig. 20); incisors slender, with three apical teeth; prosthecal tuft well developed. Maxilla: galealacinia with a row of about 18 sub-apical ribbon-like pectinate setae (Fig. 18), and at inner end of row a sclerotised comb-like seta; below the row of setae a V-shaped ridge, extended into a sclerotised projection, directed inwards; maxillary palp moderately large, terminal segment about 0.7X length of middle segment, middle segment with simple setae only. Hypopharynx (Fig. 19): lingua with well-developed lateral processes, anterior margin shallowly cleft. Labium (Figs 21-23): glossae turned down ventrally, not lying in same plane as paraglossae; terminal segment of labial palp subtriangular, length about 2X width at base, inner margin with series of short spines in apical half; terminal segment about 0.8X length and 0.9X width of middle segment. Pronotum with short spines on antero-lateral margins, and sparse setae on lateral margins. Foreleg: sharp spines and scattered long hairs along outer margin of femur (Fig. 14); extremely-finely bipectinate spines on ventral margin of tibia (Fig. 15); 18-40 simple ventral spines on tarsus; tarsal claws



Figs 1-11—*Neboissophlebia hamulata*. 1, Wings, male imago; 2, Hindwing enlarged, male imago; 3, Eyes, lateral, male imago; 4, Eyes, dorsal, male imago; 5, Abdominal segments 5 to 10, dorsal, male imago; 6, Abdominal segments 5 and 6, lateral, male imago; 7, Male genitalia, lateral; 8, Male genitalia, ventral; 9, Fore tarsal claws, male imago; 10, Sternum 7, female imago; 11, Sternum 9, female imago. Scale lines: 0.02 mm (Fig. 9); 0.2 mm (Figs 7, 8, 10, 11); 0.4 mm (Figs 2-6); 1.0 mm (Fig. 1).

smooth (Fig. 16). Abdomen: postero-lateral spines on abdominal segments 5 (small)-9; posterior margins of abdominal terga with short backwardly-directed spines, arranged in groups of 3-6, and with scattered longer hairs (Fig. 24). Gills: lamellae double (Fig. 13), on abdominal segments 1-7; each lamella long and narrow, main tracheal trunk without lateral branches and 0.3X width of lamella. Terminal filament a little longer than cerci. Midlength segments of caudal fila-

ments with apical whorl of short denticles and long setae (Fig. 25).

TYPE SPECIES: *Neboissophlebia hamulata* sp. nov.

ETYMOLOGY: The genus is named for Dr Arturs Neboiss, in recognition of his contributions to the systematics of the freshwater insects of Australia.

REMARKS: *Neboissophlebia* can be distinguished from all other genera of Leptophlebiidae by the following

combinations of characters. *Imago*. (1) Tarsal claws dissimilar (Fig. 9); (2) Sternum 9 of female with deep apical cleft (Fig. 11); (3) hindwing not greatly reduced, without a costal projection (Figs 1, 2); (4) Forewing with veins $1Cu_1$ and $1Cu_2$ parallel, never linked by crossveins or with an intercalary (Fig. 1). *Nymph*. (1) Tarsal claws smooth (Fig. 16); (2) Labrum with secondary hair fringe set back from anterior margin at about midlength of median line (Fig. 17); (3) Gills double, on abdominal segments 1 to 7; (4) Gills with lamellae long and narrow, tracheae without lateral branches (Fig. 13); (5) Foretibia with ventral spines extremely-finely bipectinate (Fig. 15).

Within the Australian fauna, there is some evidence that *Neboissophlebia* is most closely related to *Jappa* and *Ulmerophlebia*. Derived character states shared by the three genera include dissimilar tarsal claws in the adult, and in the nymph the presence of setae on the lateral margins of the pronotum, spines on the posterior margins of the abdominal terga reduced in size and occurring in groups, and the width of the tentorial body decidedly greater than the length. Characters distinguishing *Neboissophlebia* from *Jappa* and *Ulmerophlebia* include imago character (4) and nymphal characters (1), (4) and (5), above.

Character states used by Pescador and Peters (1980) to identify lineages of southern hemisphere Leptophlebiidae suggest, however, that *Neboissophlebia* belongs to the *Nousia* (= *Atalonella*) lineage. On the basis of criteria presented in table 1 of their paper, *Neboissophlebia* is excluded from the *Hapsiphlebia* lineage and included in the *Nousia* lineage primarily on the basis of certain derived features of the nymphal labrum and mandibles. Genera of the *Nousia* lineage possess, however, additional derived features of the mouth parts which are absent in *Neboissophlebia*. For example, nymphs of *Neboissophlebia* retain the secondary hair fringe across the middle of the labrum, have large glossae which are turned under ventrally, and have spines along the inner-margin of the terminal segment of the labial palp. These primitive character states are shared by genera of the *Hapsiphlebia* lineage. If *Neboissophlebia* is placed in the *Nousia* lineage, derived character states, including the dissimilar tarsal claws in the adult and the reduction of the spines on the posterior margins of the nymphal terga, would have had to evolve independently in *Neboissophlebia* and the branch of the *Hapsiphlebia* lineage leading to *Jappa* and *Ulmerophlebia*. If, on the other hand, *Neboissophlebia* is placed in the *Hapsiphlebia* lineage, parallel and independent development of certain derived features of the nymphal mouth parts in *Neboissophlebia* and in the *Nousia* lineage must be accepted. Such parallelism could arise as a consequence of the adaptation of nymphs to similar microhabitats and/or food resources.

Neboissophlebia hamulata sp. nov.

Figs 1-25

DESCRIPTION: *Male imago* (in ethanol). Length: body 6.8-7.6 mm; forewing 7.1-7.4 mm. Head: yellowish, washed with brown near anterior margin on either side

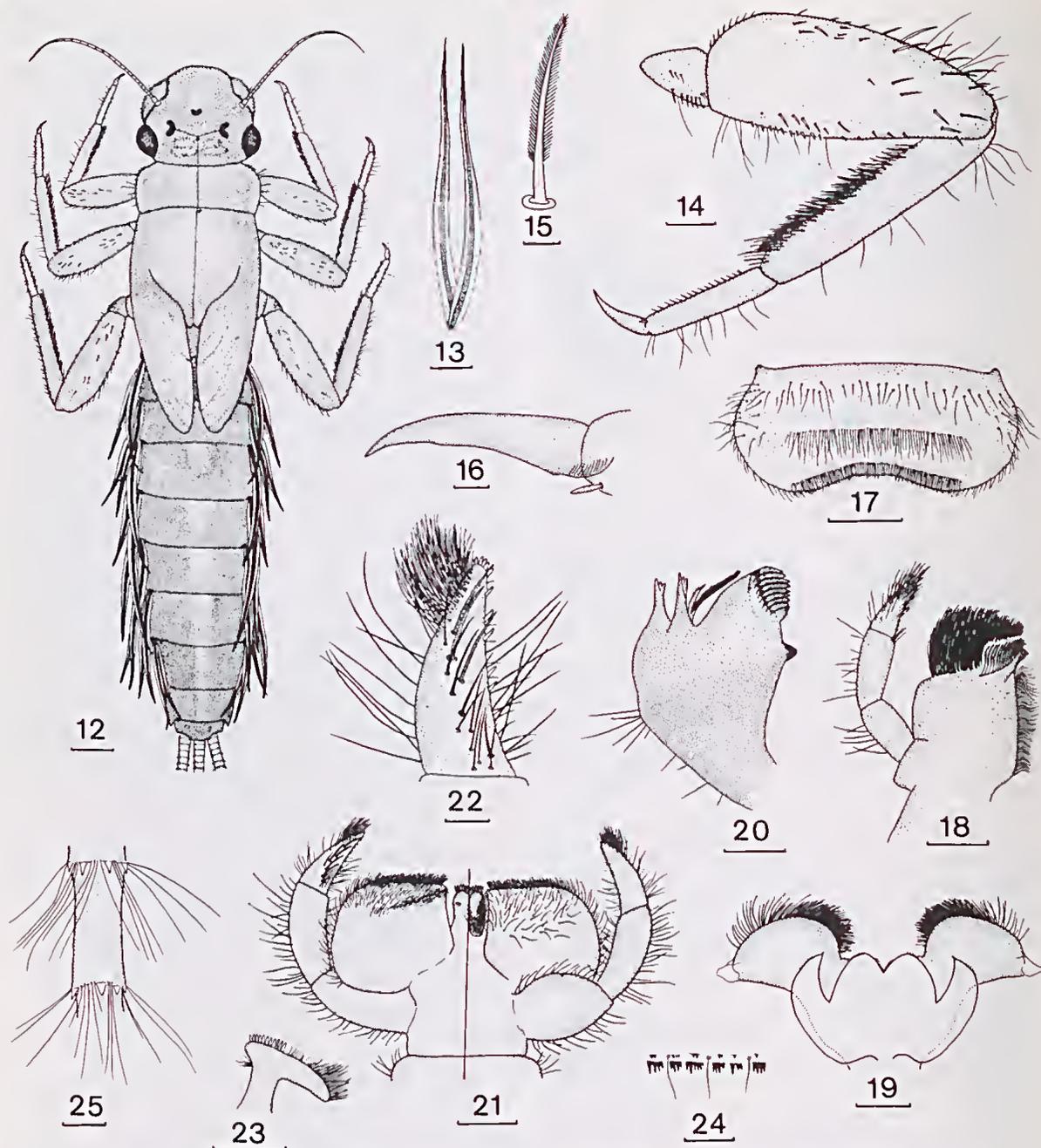
of antennae, conspicuous brown band extending back from median ocellus between lateral ocelli (Fig. 4); eyes in contact on meson of head; eyes with upper portion yellowish, lower portion grey-black, lower portion 0.6-0.7X length of upper portion (Fig. 3); antennae with scape and pedicel yellow, washed with dark brown, flagellum paler yellow; ocelli with basal half black, apical half white. Pronotum yellowish, washed with black on margins and with an irregular black streak in each half, subparallel to lateral margin and midway between lateral margin and median line. Mesonotum and metanotum pale yellow-brown. Legs: uniformly pale yellow, without markings; length ratios of segments in forelegs 0.64-0.70; 1.00 (2.2-2.3 mm); 0.04; 0.39-0.40; 0.38-0.41; 0.26-0.33; 0.10-0.11. Forewing: 4.9-5.3X length of hindwing (Fig. 1); membrane hyaline, except cells C and Sc in distal third of wing translucent; longitudinal veins and crossveins yellow; base of $1Cu_1$ always linked to $CuA-CuP$ crossvein. Abdomen: terga brown, anterior third hyaline, pale band along posterior margin, terga 2-8 with hyaline or pale band along median line, narrowing towards the posterior of each segment (Figs 5, 6); sterna brown, anterior margin hyaline, posterior margin pale yellow, sterna 3-9 paler along median line. Pcnets: pale yellow; fused in basal half, separate in distal half; each lobe with large apical projection, directed outwards and ventrally (Figs 7, 8). Caudal filaments whitish, narrow dark bands at articulations.

Female imago (in ethanol). Length: body 6.2-7.4 mm; forewing 7.3-8.3 mm. Coloration and markings similar to male imago. Head: posterior half pale, almost white; eyes separated on meson of head by a distance 3.5-4.0X maximum width of an eye. Forewing 5.4-6.3X length of hindwing. Abdomen: brown, pale areas often reduced by comparison with male imago; sternum 7 with a small genital extension, reaching less than 0.1 of the distance along sternum 8 (Fig. 10); sternum 9 with deep apical cleft (Fig. 11).

Male and female subimagos (in ethanol). Colour and markings as in imagos, except abdomen without hyaline areas, pale yellow-white instead. Wings uniformly grey-white.

Mature nymph (in ethanol). Length of body 6.7-9.2 mm. Head: orange-brown, pale area anterior to median ocellus and also between lateral ocelli and eyes, darker-brown, submedian markings between eyes; antennae pale yellow; width of labrum 2.3-2.4X length along median line, anterior concavity shallow. Thorax orange-brown, paler ventrally. Legs: uniformly yellow-brown, without markings; tarsus of foreleg with 18-21 ventral spines. Abdomen: orange-brown, venter paler; pale mid-dorsal band on abdominal segments 3-9, generally broadening to anterior of each segment (Fig. 12). Gills with lamellae yellow-white, tracheae brown. Caudal filaments orange-brown at base, becoming paler towards apex, without banding.

TYPE MATERIAL: Holotype: ♂ imago, Victoria, Tarago River, 7 km W of Neerim, 1 Mar. 1972 (Neboiss) (MVM T-8833). Paratypes: all collected with holotype. ♂ imago (wings, foreleg mounted on slides) (MVM



Figs 12-25—*Neboissophlebia hamulata*, nymph. 12, Whole nymph; 13, Gills, abdominal segment four; 14, foreleg; 15, Ventral spine, foretibia; 16, Tarsal claw; 17, Labrum; 18, Left maxilla, ventral; 19, Hypopharynx; 20, Left mandible, dorsal; 21, Labium, dorsal (left) and ventral (right) aspects; 22, Terminal segment of labial palp, dorsal; 23, Glossae, lateral; 24, Spines, posterior margin of abdominal tergum four; 25, Cercus, midlength. Scale lines: 0.02 mm (Figs 15, 24); 0.05 mm (Figs 16, 22, 25); 0.2 mm (Figs 13, 14, 17-21, 23); 0.5 mm (Fig. 12).

T-8834, Figs 1-9); 5 ♂♂ imagos (MVM T-8835 to T-8839); ♂ subimago (MVM T-8840); 6 ♀♀ imagos (MVM T-8841 to T-8846, Figs 10, 11).

OTHER MATERIAL EXAMINED: Victoria—♂ imago (reared from nymph, Figs 15-18, 20-25), Starvation Creek, 14 km E of Warburton, 19 Dec. 1979 (Dean);

♂ imago, 4 ♂♂ subimagos, 3 ♀♀ subimagos (all reared from nymphs), Starvation Creek, 14 km E of Warburton, various dates (Dean); ♂ imago, ♀ imago, 3 nymphs (Figs 12-14, 19), Starvation Creek, 14 km E of Warburton, various dates (Dean); ♂ imago, Yarra River, Woori Yallock, 6 Feb. 1978 (Dean); ♂ imago, Yarra River, O'Shannassy Road, 1 Feb. 1980

(Dean); 1 nymph, O'Shannassy River, 4 km u/s O'Shannassy Reservoir, 12 Dec. 1975 (Dean); 1 nymph, Crystal Brook, Mt. Buffalo, 7 Jun. 1977 (Dean); 2 ♀♀ imagos, Murrindindi River, 1 Feb. 1984 (Neboiss); 4 ♂♂ imagos, ♀ imago, 4 ♂♂ subimagos, Diamond Creek, 7 km SE of Gembrook, 31 Jan. 1979 (Wells, Neboiss); 4 ♂♂ imagos, Matlock Creek, 14 km W of Aberfeldy, 10 Feb. 1977 (Calder); ♀ imago, Noorinbee North, 20 Mar. 1977 (Neboiss); ♂ imago, Thomson River, 6 km S of Aberfeldy, 9 Feb. 1977 (Calder); ♂ imago, ♀ imago, Tanjil River Junction, 10 km N of Willow Grove, 18 Dec. 1973 (Neboiss); ♀ imago, Genoa Creek Falls, 3 km W of Genoa, 28 Mar. 1974 (Neboiss); ♂ imago, ♀ imago, Jordan River, Jericho, 28 Nov. 1976 (Calder); ♀ imago, Yea River, 7 km S of Glenburn, 1 Dec. 1972 (Neboiss); ♂ imago, 3 km W of Beenak, 7 Jan. 1972 (Neboiss); ♂ imago, Tanjil River, Walhalla Road, 20 Feb. 1974 (LRES); 2 ♂♂ subimagos, Little River, 3 km SE of Taggerty, 6 Jan. 1972 (Neboiss); ♂ imago, 8 km NE of Toolangi, 2 Dec. 1970 (Neboiss); ♂ imago, Toorong Falls, NE of Noojee, 17 Dec. 1970 (Neboiss); 3 ♂♂ imagos, 3 ♂♂ subimagos, Upper Macalister River, above Howitt Plains, 25 Feb. 1979 (Calder); ♂ imago, Taggerty River, 4 km E of Marysville, 26 Dec. 1974 (Neboiss); 2 ♂♂ imagos, Wingan River, 8 km S of Princes Highway, 30 Jan. 1975 (Neboiss); ♂ imago, Wonnangatta River, E of Mt Howitt, 11 Feb. 1981 (Blyth); New South Wales — ♀ imago, Wallagaraugh River, Princes Highway, 29 Jan. 1975 (Neboiss); ♂ imago, Leather Barrel Creek, Alpine Way, 6 Feb. 1985 (Dean).

DISTRIBUTION: South-eastern Australia.

ETYMOLOGY: *hamulus* (Latin), a small hook, a reference to the shape of the male genitalia.

Neboissophlebia occidentalis sp. nov.

Figs 26-32

Leptophlebiidae sp.A, Bunn *et al.* (1986)

DESCRIPTION: *Male imago* (in ethanol). Length: body 8.0-8.4 mm; forewing 7.9-8.3 mm. Head: brown, darker markings near anterior margin on either side of antennae, thin dark band extending back from median ocellus between lateral ocelli; eyes with upper portion orange-brown, lower portion grey-black; antennae with scape and pedicel brown, flagellum pale yellow. Pronotum yellow-brown, dark brown on lateral margins and a thin, dark band medially on posterior margin. Mesonotum and metanotum yellow. Legs: uniformly pale yellow-brown, without markings; length ratios of segments in forelegs 0.65-0.72; 1.00 (2.2-2.6 mm); 0.04-0.05; 0.33-0.40; 0.40-0.46; 0.34-0.39; 0.11-0.12. Forewing: length 2.9-3.0X width (Fig. 26); membrane hyaline, cells C and Sc in distal third of wing translucent, white; longitudinal veins and crossveins yellow; base of 1Cu, usually linked to CuA-CuP crossvein, although in a few specimens base of 1Cu, linked by crossvein to CuA in one or both wings; forewing 4.9-5.2X length of hindwing. Abdomen:

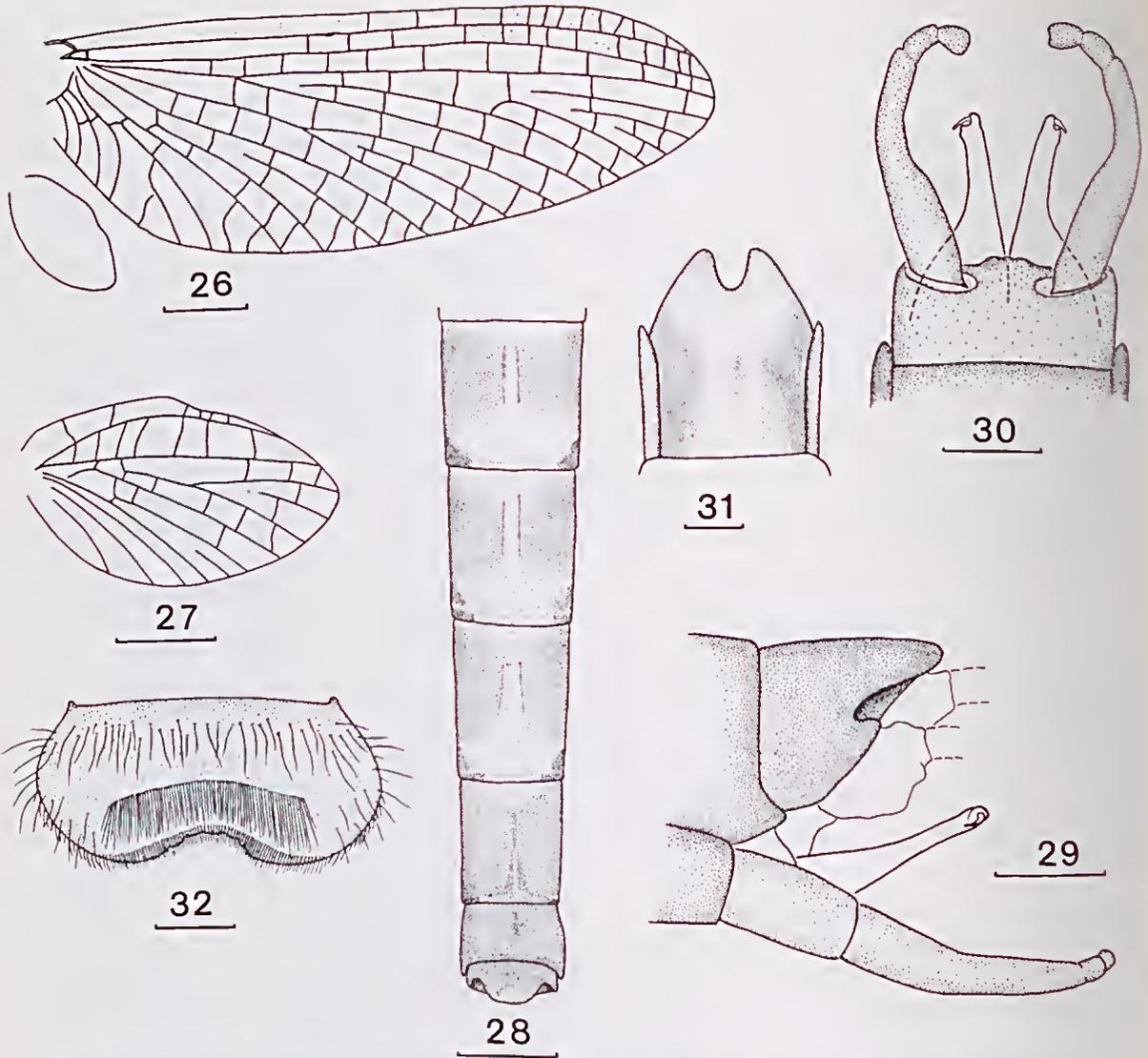
brown; terga 1 and 2 with pale yellow-white bands adjacent to anterior and posterior margins, the two areas linked by a mid-dorsal pale band, terga 3 to 7 with similar pattern, but hyaline instead of pale (Fig. 28), some specimens with weakly-developed thin dark lines on either side of the mid-dorsal band, terga 8 to 10 more uniform pale brown, some specimens with reddish-brown streaks on mid-dorsal line of segments 8 and 9; sterna 1 and 2 brown, 3 to 7 hyaline along midline and brown towards lateral margins. Claspers pale brown-yellow in basal half, white in distal half. Penes: pale yellow; fused in basal half, separate in distal half (Fig. 30); each lobe with small spine-like apical projection, directed outwards. Caudal filaments pale yellowish-white, with narrow dark brown bands at articulations.

Female imago (in ethanol). Length: body 7.4-8.3 mm; forewing 7.5-9.0 mm. General colour and pattern similar to male imago. Head: pale yellow, almost white in posterior half; eyes separated on meson of head by a distance of about 4X the maximum width of an eye. Forewing 5.3-6.0X length of hindwing. Abdomen: brown, pale areas often reduced by comparison with male imago; sternum 9 with apical cleft (Fig. 31).

Male and female subimagos (in ethanol). Colour and markings similar to imagos, except abdomen usually without hyaline areas, pale yellow instead. Wings uniformly pale greyish-yellow.

Mature nymph (in ethanol). Length of body 7.9-10.3 mm. Head: orange-brown, submedian dark brown markings towards posterior of head; dark brown marks linking lateral ocelli and median ocellus; antennae pale yellow; width of labrum about 2.5X length along medianline, anterior margin with moderately deep concavity. Thorax orange-brown, pronotum with darker markings along lateral margins. Legs: pale yellow-brown, slightly darker bands near base of tibia, at midlength of tibia and tarsus, and less conspicuously near apex of femur; tarsus of foreleg with 35-40 ventral spines. Abdomen: orange-brown, venter paler, most segments with mid-dorsal pale longitudinal band, generally narrowing towards posterior of segment. Gills with lamellae greyish, tracheae very dark almost black. Caudal filaments brown, without darker annulations.

REMARKS: *Neboissophlebia occidentalis* is readily distinguished from *N. hamulata* by the distinctive form of the male genitalia and the smaller apical cleft on sternum 9 of the female imago. The nymph of *N. occidentalis* has a deeper concavity on the anterior margin of the labrum, 35-40 ventral spines on the foretarsus compared to 18-21 in *N. hamulata*, and darker banding on the tibia and tarsus of all legs whereas the legs of *N. hamulata* are uniformly pale. *N. occidentalis* is probably the species figured by Ulmer (1908) under the name *Atalophlebia furcifera* Eaton. However, examination of the holotype of *A. furcifera*, which is deposited in the Museum of Victoria, clearly indicates that Ulmer's specimen was not that species.



Figs 26-32—*Neboissophlebia occidentalis*. 26, Wings, male imago; 27, Hindwing enlarged, male imago; 28, Abdominal segments 5 to 10, dorsal, male imago; 29, Male genitalia, lateral; 30, Male genitalia, ventral; 31, Sternum 9, female imago; 32, Labrum nymph. Scale lines: 0.2 mm (Figs 29-32); 0.5 mm (Figs 27, 28); 1.0 mm (Fig. 26).

TYPE MATERIAL: Holotype: ♂ imago, SW Australia, Harvey River, 15 km E of Harvey, 21 Nov. 1978 (Neboiss) (MVM T-8847). Paratypes: all collected with holotype. ♂ imago (wings, forelegs, genitalia mounted on slides) (MVM T-8848, Figs 26-28); ♂ imago (MVM T-8849, Figs 29-30); 8 ♂ imagos (MVM T-8850 to T-8857); 5 ♂♂ subimagos (MVM T-8858 to T-8862); ♀ imago (MVM T-8863); 2 ♀♀ subimagos (MVM T-8864, T-8865).

OTHER MATERIAL EXAMINED: SW Australia—♀ imago (reared from nymph), Jarrahdale, Waterfall Gully, 19 Apr. 1982 (Bunn); 2 ♀♀ subimagos, Jarrahdale, Waterfall Gully, 5 May 1983 (Bunn); ♀ imago (Fig. 31), 2 ♀♀ subimagos (all reared from nymphs), North Dandalup, Foster Brook, 14 Nov. 1983 (Bunn); ♂

subimago, Jarrahdale, Seldom Seen Brook, 19 Jan. 1982 (Bunn); 1 nymph (Fig. 32), Jarrahdale, Seldom Seen Brook, 25 Jan. 1982 (Bunn); 1 nymph, Jarrahdale, Seldom Seen Brook, 14 Dec. 1981 (Bunn); 3 nymphs, Jarrahdale, Waterfall Gully, 18 May 1981 (Bunn); ♂ imago, 3 ♂♂ subimagos, ♀ subimago, Deep River, 10 km W of Walpole, 9 Dec 1979 (Blyth); 3 ♂♂ subimagos, Ellen Brook Falls, 10 km NW of Margaret River, 4 Dec. 1979 (Blyth); 4 ♀♀ imagos, 24 ♂♂ subimagos, 21 ♀♀ subimagos, Warren River, Warren National Park, 8 Dec. 1979 (Blyth); 2 ♂♂ subimagos, ♀ subimago, Beedelup Falls, 16 km W of Pemberton, 8 Dec. 1979 (Blyth); 1 nymph, Carey Brook, 20 km W of Pemberton, 26 Nov. 1978 (Neboiss); 4 nymphs, Scott River, NE of Augusta, 25 Nov. 1978 (Neboiss).

DISTRIBUTION: South-western Australia.

ETYMOLOGY: *occidentalis* (Latin), western, a reference to the known distribution of the species.

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